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RATIONS FOR FEEDING POULTRY IN THE PACKING HOUSE.

[From the Food Research Laboratory.[1]]

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PURPOSE OF INVESTIGATION.

Poultry fleshing or finishing is rapidly becoming a very important specialized phase of the poultry industry of the United States. It does not seem to be feasible to fatten poultry extensively on the farm for the reason that dressed poultry, being highly perishable, requires chilling and holding, the facilities for which the farmer ordinarily lacks. Moreover, the shrinkage in weight which occurs when the fattened birds are shipped alive from the farm to the packing house usually offsets the gain obtained during the fleshing period. As practiced in the modern poultry-packing plant, fleshing may be considered a manufacturing process whereby the range birds received by the packer are put in condition for the market. This is accomplished by intensive feeding for a period of from 7 to 14 days, followed by dressing, chilling, grading, and packing.

The twofold object of fleshing poultry is to add a substantial amount of flesh to the fowls and to improve the quality of the edible portion. The finishing process adds weight to the edible parts more rapidly than to the inedible parts, thus increasing the value of such poultry to the consumer. The producer's gain lies in the fact that the

[1] This bulletin was compiled by J. S. Hepburn, junior chemist, and R. C. Holder, assistant chemist, under the direction of H. A. McAleer, chief, and M. E. Pennington, formerly chief, Food Research Laboratory. The chemical part of the investigation, which covered a period of four years, was done by A. W. Broomell, A. D. Greenlee, J. S. Hepburn, R. C. Holder, E. F. Kohman, H. A. Shonle, and G. C. Swan. The feeding work was done by H. C. Bowman, J. M. Borders, R. L. Cochran, L. E. Harker, A. C. Klingman, P. L. Sanford, H. L. Shrader, C. E. Sidler, R. L. Skinner, and P. S. White. D. C. Kennard assisted in the compilation of the data here reported.

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packer buys the surplus of this seasonal product when it is available, puts it in condition for the market, and holds it in cold storage until needed.

The ration and methods of feeding must be designed to accomplish the desired results. For instance, the kind of ration and length of feeding period should vary with the age and class of the birds. In order to secure such information, poultry-fleshing experiments were begun by the Food Research Laboratory in 1916. In connection with these experiments, data on the losses due to dressing, such as blood, feathers, and offal, and on the loss caused by chilling were secured. Representative lots of birds were selected before and after feeding for dissection into their edible and inedible components. Chemical analyses of the various edible portions were made to determine the composition of the range or unfattened birds as compared with that of similar birds after fleshing.

METHODS OF PROCEDURE.

Two types of experiments were conducted:

(1) *Twelve-bird experiments.*—The metal batteries, commonly used in poultry-feeding houses, were partitioned into individual compartments, 12 by 18 inches. Each bird was supplied with an individual cup so constructed as to eliminate all possible waste of feed. Thus an accurate record of each bird's feed consumption was obtained. As far as possible all variations in size and vigor of the birds were eliminated, so that the results indicate the effects of the rations on normal birds, rather than the gains which can be made with the rations fed under packing-house conditions. The birds were fed twice daily, at 8 a. m. and at 4 p. m. Each was weighed at the beginning of the experiment, and again on the fourth, eighth, eleventh, and fourteenth day. After selection, the birds were held for a preliminary period of 24 hours, during which time they received only a light feed of corn meal and buttermilk, in order that the contents of their digestive tracts might be uniform at the beginning of the experiment. In conformity with the usual practice, they were fed sparingly for the first three days, the amount of feed being gradually increased to full feed according to their desire until about the sixth day. As the object at all times was to maintain a keen appetite, any feed remaining at the end of 20 or 30 minutes was removed. At the time of feeding, an experimental ration, consisting of corn meal (40 parts) and buttermilk (60 parts), was fed to similar birds selected as controls. The results secured with each experimental ration were compared directly with those secured with the control ration. The efficiency of the ration fed to the control was given the value of 100, and the values of the experimental

rations were calculated. In this way the variations resulting from differences in the weather, the physical condition of the birds, etc., were reduced.

(2) *Battery experiments.*—The second series of experiments was conducted with a larger number of birds fed in batteries under packing-house conditions. Instead of securing the individual weights or feed consumption data, the total weight of the birds and their total feed consumption were recorded and the average gain and feed consumed by each bird calculated. Except that the control ration of corn meal and buttermilk was not always fed with the experimental rations, the methods were practically the same as those employed in the 12-bird experiments.

In the small-scale experiments, dressing and chilling records on different classes of birds were kept, to show the losses occurring before and after feeding. The weights of the birds were recorded just before slaughter, after killing, and after cooling in a mechanically refrigerated chill room for 24 hours. These birds were then dissected into meat, skin, edible organs, crude gizzard fat, offal, and bones. Thus records were obtained of the edible and inedible portions of the different classes before and after feeding. The edible parts were analyzed for their moisture, fat, and protein content.

RESULTS OF INVESTIGATION.

Table 1 shows the composition of the various poultry feeds employed in these experiments. The results of the experimental work are given in Tables 2 to 16, inclusive. In the battery experiments all weights were obtained and recorded in avoirdupois units. In the 12-bird experiments the weights were obtained in metric units of weight (grams), but, for the convenience of the reader, they are recorded in avoirdupois units (pounds or ounces). Percentage figures in the tables giving data on the 12-bird experiments were calculated from the original weights expressed in grams.

TABLE 1.—*Composition of poultry feeds used.*

Feeds.	Protein.	Fat.	Carbohydrates.		Ash.	Water.	Solids.
			Nitrogen-free extract.	Fiber.			
Cereal grains and by-products:	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Barley, whole ground	12.31	3.00	61.53	7.38	5.79	9.99	90.01
Corn meal	8.94	4.48	70.91	2.71	1.26	11.70	88.30
Oats, whole ground	10.86	5.96	55.73	15.12	3.36	8.97	91.03
Oatmeal	15.90	6.60	65.80	1.70	2.10	7.80	92.20
Oat middlings	16.38	7.84	59.80	2.31	2.53	11.14	88.86
Oat flour	16.19	7.32	65.92	1.58	1.30	7.69	92.31
Oats, rolled	16.31	6.64	65.94	1.01	2.05	8.05	91.95
Rice bran	12.06	12.21	43.32	12.19	11.96	8.26	91.74
Rice polish	13.74	12.46	56.87	2.19	5.78	8.96	91.04
Wheat, whole ground	12.20	2.00	71.50	2.00	1.90	10.20	89.80
Wheat, low-grade flour	19.94	5.07	59.34	5.07	3.33	9.96	90.04
Wheat, standard middlings	17.00	6.04	55.83	6.73	3.96	10.44	89.56
Oil-bearing seed by-products:							
Coconut meal	19.56	8.65	45.71	9.78	7.52	8.78	91.22
Peanut flour	44.34	9.12	29.74	4.16	4.45	8.19	91.81
Peanut meal with hulls	22.31	5.56	25.11	37.03	3.18	6.81	93.19
Rapeseed meal	26.00	11.50	42.73	8.05	5.36	6.36	93.64
Soy-bean meal	42.75	7.95	30.20	5.27	5.66	8.17	91.85
Grain sorghums:							
Kafir[1]	11.10	3.00	70.10	2.30	1.70	11.80	88.20
Milo, whole ground[1]	10.70	2.00	70.50	2.40	2.80	10.70	89.30
Roughage:							
Alfalfa	12.81	1.85	34.25	32.51	10.04	8.54	91.46
Animal products:							
Meat scrap	51.62	9.69	6.52	2.26	21.96	7.95	92.05
Buttermilk, natural	3.50	.40	4.35	.....	.75	91.00	9.00
Buttermilk, semisolid	11.88	2.20	11.23	.....	3.31	71.38	28.62
Buttermilk, powdered	33.32	3.26	41.33	.....	14.35	7.74	92.26

[1] Analyses taken from Henry and Morrison, "Feeds and Feeding," p. 635, published by the Henry Morrison Co., 1917.

TABLE 2.—*Results of fleshing broilers (12-bird experiments).*

No.	Ration. Special feeds.	Corn meal.	Butter-milk.	Initial weight.[1]	Gain. Experimental ration.		Control ration.	Relative gain.[2]	Feed per pound gain, experimental ration.
		Per cent.	*Per cent.*	*Lbs.*	*Lbs.*	*Per cent.*	*Per cent.*	*Per cent.*	*Lbs.*
1	Peanut meal	8.33	25.00	66.67	1.9	0.61	32.09	24.92	129	2.81
					1.7	.56	32.87	35.58	92	3.42
2	Peanut meal	10.00	20.00	70.00	1.4	.67	47.85	30.10	159	2.64
					2.1	.83	39.61	32.92	120	2.55
3	Peanut meal	10.00	23.33	66.67	1.7	.64	37.76	25.28	149	3.03
					1.8	.80	44.25	33.47	132	3.45
4	Peanut meal	5.00	23.33	66.67	1.8	.78	43.60	33.47	130	2.63
	Rice bran	5.00	.....	.....	1.3	.55	42.65	35.08	122	2.83
5	Peanut meal, Low-grade flour, Rice bran	7.50, 3.00, 1.50	18.00	70.00	1.4	.72	51.39	30.10	171	2.47
					2.1	.85	40.29	32.92	122	2.48
6	Peanut meal, Low-grade flour, Rice bran	9.00, 4.50, 4.50	12.00	70.00	1.4	.66	47.49	30.10	158	2.65
					2.1	.70	33.19	32.92	101	2.82
7	Peanut meal, Low-grade flour, Middlings (standard wheat)	7.50, 3.00, 4.50	15.00	70.00	1.9	.75	39.30	35.73	110	3.05
					1.9	.95	49.93	35.73	140	2.64
					2.2	1.20	53.05	44.20	120	2.27
8	Peanut meal, Low-grade flour, Middlings (standard wheat)	9.00, 3.00, 3.00	15.00	70.00	1.4	.82	58.92	30.10	196	2.27
					2.1	.77	36.82	32.92	112	2.70
9	Coconut meal	5.00	28.33	66.67	2.0	.44	22.08	16.51	134	3.38
					2.3	.73	31.95	28.15	113	3.05
					1.9	.76	39.96	36.10	111	2.94
10	Coconut meal	8.33	25.00	66.67	2.0	.40	19.88	16.51	120	3.34
					2.3	.84	36.49	28.18	129	2.85
					1.9	.69	36.42	36.10	101	3.07
11	Coconut meal	13.33	20.00	66.67	2.0	.28	13.78	16.51	83	4.50
					2.4	.51	21.38	28.18	76	3.92
					1.9	.53	27.78	36.10	77	3.58
12	Soy-bean meal	8.33	25.00	66.67	1.6	.86	54.04	49.05	110	2.19
					2.0	.57	28.85	16.51	174	2.66
					2.2	.80	36.47	28.18	129	2.62
					1.7	.58	34.34	35.58	97	3.12
13	Soy-bean meal, Meat scrap, Water	6.67, 1.67, 60.00	25.00	6.67	2.0	.46	23.10	16.51	140	3.44
					2.2	.55	24.94	28.18	89	4.14
14	Rapeseed meal	5.00	28.33	66.67	1.9	.36	18.96	24.92	76	4.08
					2.4	.55	22.90	20.23	113	3.08
15	Rapeseed meal	8.33	25.00	66.67	1.9	.38	19.91	24.92	80	3.94
					2.5	.34	13.79	20.23	68	4.49
16	Rice bran	10.00	23.33	66.67	1.8	.60	33.31	33.47	100	3.16
					1.3	.48	36.82	35.08	105	3.36
17	Rice bran, Alfalfa meal	10.00, 3.33	20.00	66.67	1.8	.62	34.56	33.47	103	3.32
					1.3	.48	36.60	35.08	104	3.33
18	Rice bran, Meat scrap	10.00, 3.33	20.00	66.67	1.8	.69	38.12	33.47	114	2.90
					1.3	.51	38.90	35.08	111	3.19
19	Low-grade flour, Middlings (standard wheat), Peanut flour	3.00, 6.00, 6.00	15.00	70.00	2.1	1.16	55.30	44.20	125	2.09
					1.9	.74	38.72	35.73	108	2.73
					1.9	.74	39.03	35.73	109	2.85
20	Kafir meal	40.00	.....	60.00	1.7	.38	22.61	29.55	77	4.79
					1.8	.52	29.02	32.17	90	3.44

[1] Average per bird.

[2] Control taken as 100 per cent.

TABLE 3.—*Results of fleshing broilers (battery experiments).*

Ration.[1] No.	Special feeds.	Corn meal.	Butter-milk.	Number of birds.	Days fed.	Initial weight.	Gain. Experimental ration.	Gain. Control ration.	Relative gain.[2]
		Per ct.	*Per ct.*			*Lbs.*	*Lbs.*	*Per ct.*	*Per ct.*
1	Peanut meal	8.33	25.00	66.67	52	14	1.83	0.27	14.75	18.09	82
2	Peanut meal	10.00	23.33	66.67	40	8	1.58	.55	34.81	19.07	183
3	Peanut meal	8.33	25.00	66.67	79	8	1.21	.27	22.31	24.81	90
4	Peanut meal Velvet bean meal	8.33 5.00	25.00	66.67	77	8	1.18	.44	37.60	24.81	152
5	Peanut meal Rice bran	5.00 5.00	23.33	66.67	40	8	1.69	.45	20.63	19.07	108
6	Peanut meal Coconut meal	8.33 8.33	16.67	66.67	40	14	2.66	.60	22.56	21.69	104
[3] 7	Peanut meal Ground oats Low-grade flour	7.50 4.50 3.00	15.00	70.00	100	8	1.68	.55	32.73	22.84	143
8	Rapeseed meal	5.00	28.33	66.67	39	14	2.38	.33	13.87	13.55	102
9	Rapeseed meal	8.33	25.00	66.67	39	14	2.56	.21	8.82	13.65	65
10	Coconut meal	5.00	28.33	66.67	40	14	2.58	.73	28.29	21.69	130
[3] 11	Coconut meal	8.33	25.00	66.67	104	14	2.39	.44	18.41	23.00	74
12	Coconut meal	13.33	20.00	66.67	64	14	1.92	.27	14.06	18.09	78
13	Coconut meal	16.67	16.67	66.67	40	14	2.43	.61	25.10	21.69	116
14	Coconut meal Meat scrap	8.33 3.33	21.67	66.67	118	11	2.16	.57	26.39	21.39	123
15	Sesame-seed meal	8.33	25.00	66.67	122	11	2.07	.62	29.95	21.39	140
[3] 16	Rice bran	10.00	23.33	66.67	50	8	1.83	.35	19.13	23.66	81
17	Sesame-seed meal	9.09	18.18	72.73	1,169	10	.80	.32	40.00	.....	.....
18	Sesame-seed meal Ground wheat	5.60 11.20	11.20	72.00	1,159	10	.88	.41	46.59	.....	.....
[3] 19	Soy-bean meal	10.00	20.00	70.00	2,310	10	1.05	.31	29.04	.....	.....
[3] 20	Soy-bean meal Wheat flour	9.09 9.09	18.80	63.64	1,598	10	.96	.38	39.65	.....	.....
21	Wheat flour	14.00	14.00	72.00	1,130	10	1.21	.30	24.79	.....	.....
22	Ground oats Ground barley	15.00 5.00	20.00	60.00	72	14	.92	.28	30.43	.....	.....
23	Ground milo Rice polish	20.00 15.00	5.00	60.00	72	14	.84	.36	42.86	.....	.....
24	Ground milo Rice polish Ground beans	20.00 15.00 5.00	.....	60.00	72	14	.83	.29	34.94	.....	.....
25	Ground milo Rice bran Ground beans	20.00 15.00 5.00	.....	60.00	71	14	.94	.21	22.34	.....	.....
26	Ground milo Rice bran Boiled potatoes	20.00 5.00 20.00	.....	55.00	72	14	.85	.37	43.53	.....	.....

[1] Rations 1 to 16, inclusive, were fed to the usual "house run" of birds, other than Leghorns. Rations 17 to 26, inclusive, were fed to Leghorns only.
[2] Control taken as 100 per cent.
[3] Average from two experiments.

TABLE 4.—*Results of fleshing springs (battery experiments).*

No.	Ration. Special feeds.		Corn meal.	Buttermilk.	Number of birds.	Days fed.	Initial weight.	Gain.	
		Per ct.	*Per ct.*	*Per ct.*			*Lbs.*	*Lbs.*	*Per ct.*
1	Low-grade flour	5.25	17.5	65.00	390	14	3.45	0.72	20.87
	Middlings (standard wheat)	5.25			391	14	3.35	.61	18.21
	Rolled oats	7.00			395	14	3.36	.61	18.15
					391	14	3.23	.56	17.34
2	Low-grade flour	5.00	16.67	66.67	596	14	2.61	.73	27.97
	Middlings (standard wheat)	6.67			596	14	2.53	.62	24.51
	Oat flour	5.00			594	14	2.76	.65	23.55
					591	14	3.00	.68	22.66
					598	14	2.92	.53	18.15
					594	14	2.94	.55	18.71
					597	14	3.39	.60	17.70
					509	14	3.41	.53	15.54
3	Low-grade flour	4.50	15.00	70.00	645	14	2.66	.68	25.56
	Middlings (standard wheat)	6.00			781	14	2.85	.49	17.19
	Ground oats	4.50			621	14	2.98	.72	24.16
					751	14	2.77	.53	19.13
					689	14	2.74	.53	19.34
					782	14	2.83	.63	22.26
					787	14	3.11	.78	25.08
4	Low-grade flour	1.67	20.00	66.67					
	Middlings (standard wheat)	3.33			125	8	4.14	.92	22.22
	Oatmeal	8.33			391	8	3.65	.38	10.41
5	Low-grade flour	1.67	20.00	66.67					
	Middlings (standard wheat)	3.33							
	Oatmeal	8.33			391	14	3.23	.56	17.34
6	Low-grade flour	3.00	15.00	70.00					
	Middlings (standard wheat)	4.50			381	14	2.58	.93	36.05
	Peanut meal	7.50			286	14	2.18	.95	43.58
					574	14	2.52	.75	29.76
					573	14	2.64	.89	33.71

TABLE 5.—*Results of fleshing hens (12-bird experiments).*

No.	Ration. Special feeds.		Corn meal.	Buttermilk.	Initial weight.[1]	Gain. Experimental ration.		Control ration.	Relative gain.[2]	Feed per pound gain, experimental ration.
		Per ct.	*Per ct.*	*Per ct.*	*Lbs.*	*Lbs.*	*Per ct.*	*Per ct.*	*Per ct.*	*Lbs.*
1	Peanut meal	13.33	20.00	66.67	4.9	0.95	19.30	12.83	151	3.20
					5.1	−.19	−3.69	7.00	4	.....
					4.9	.41	8.32	10.34	80	6.30
2	Peanut meal	11.00	20.00	66.67	4.9	.48	16.61	12.83	129	3.61
	Meat scrap	2.33			5.2	.66	12.65	7.00	182	4.16
					5.0	.33	6.68	10.34	64	7.74
3	Peanut meal	10.00	20.00	66.67	4.9	.74	15.11	12.83	118	3.76
	Meat scrap	2.33			5.2	.51	9.77	7.00	140	4.54
	Alfalfa meal	1.00			4.9	.25	5.13	10.34	50	9.51
4	Peanut meal	10.00	20.00	66.67	4.9	.49	9.98	12.83	78	5.64
	Meat scrap	1.00			5.1	.19	3.68	7.00	53	12.96
	Alfalfa meal	2.33			4.9	.43	8.81	10.34	85	4.65
5	Peanut meal	11.00	20.00	66.67	4.9	.55	11.15	12.83	87	5.50
	Alfalfa meal	2.33			5.3	−.05	−.95	7.00	15	.....
					4.9	.34	6.96	10.34	67	7.53
6	Boiled potatoes	14.81	29.63	55.56	5.2	.83	16.04	10.36	155	5.44
					5.1	.49	9.70	13.94	70	10.40

[1] Average per bird.

[2] Control taken as 100 per cent.

TABLE 6.—*Results of fleshing hens (battery experiments).*

No.	Ration. Special feeds.	Corn meal.	Buttermilk.	Number of birds.	Days fed.	Initial weight.	Gain. Experimental ration.	Gain. Control ration.	Relative gain.[1]
		Per ct.	*Per ct.*			*Lbs.*	*Lbs.*	*Per ct.*	*Per ct.*
1	Ground oats	10.00	30.00	60.00	39	14	5.01	1.76	15.17	13.17	115
2	Ground oats	10.00	30.00	60.00	76	10	4.58	.45	9.83	10.62	93
3	Ground oats	10.00	30.00	60.00	80	8	3.98	.33	8.29	7.66	108
4	Ground oats	11.67	16.67	66.67	72	10	4.46	.65	14.57	10.62	137
	Meat scrap	5.00	.....	.....							
5	Ground oats	11.67	16.67	66.67	77	8	3.96	.31	7.83	7.66	102
	Meat scrap	5.00	.....	.....							
6	Ground oats	13.33	18.00	66.67	39	14	5.25	.42	8.00	13.17	61
	Alfalfa meal	2.00	.....	.....							
7	Ground oats	11.33	18.00	66.67	37	14	5.38	.52	9.67	13.17	73
	Alfalfa meal	2.00	.....	.....							
8	Ground oats	9.33	18.00	66.67	38	14	5.40	.44	8.15	13.17	62
	Alfalfa meal	4.00	.....	.....							
	Meat scrap	2.00	.....	.....							
9	Ground oats	11.67	16.67	66.67	75	10	4.37	.35	6.01	10.62	57
	Alfalfa meal	3.33	.....	.....							
	Meat scrap	1.33	.....	.....							
	Charcoal	.33	.....	.....							
10	Ground oats	11.67	16.67	66.67	79	8	3.96	.28	7.07	7.66	92
	Alfalfa meal	3.33	.....	.....							
	Meat scrap	1.33	.....	.....							
	Charcoal	.33	.....	.....							
11	Velvet-bean meal	4.00	29.33	66.67	40	8	4.56	.33	7.24	6.22	116
					40	8	4.40	.26	5.91	6.22	85
12	Soy-bean meal	8.33	25.00	66.67	40	8	4.84	.20	4.09	6.22	66
13	Soy-bean meal	8.33	25.00	.....	40	8	4.88	−.05	−1.02	6.22	.....
	Water	66.67	.....	.....							
14	Soy-bean meal	7.00	25.33	66.67	39	8	4.88	.19	3.90	6.22	63
	Meat scrap	1.00	.....	.....							
15	Meat scrap	1.67	25.00	.....	40	8	4.89	.20	4.09	6.22	66
	Water	66.67	.....	.....							
16	Peanut meal	7.00	25.33	66.67	40	8	3.89	.30	7.71	6.22	124
	Alfalfa meal	1.00	.....	.....							
17	Low-grade flour	4.50	15.00	70.00	501	11	3.25	.40	12.30	.....	.....
	Middlings (standard wheat)	3.00	.....	.....	497	14	3.50	.45	12.86	.....	.....
	Peanut flour	7.50	.....	.....							
18	Low-grade flour	1.67	20.00	66.67	495	14	3.14	.43	13.69	.....	.....
	Middlings (standard wheat)	3.33	.....	.....	481	14	3.20	.17	5.31	.....	.....
	Oat middlings	8.33	.....	.....							
19	Low-grade flour	1.67	20.00	66.67	316	8	3.56	.46	12.92	.....	.....
					320	8	3.72	.54	14.50	.....	.....
	Middlings (standard wheat)	3.33	.....	.....	323	8	3.74	.53	14.17	.....	.....
	Oat middlings	8.33	.....	.....	628	8	3.83	.51	13.31	.....	.....
					640	8	3.92	.27	6.89	.....	.....
20	Low-grade flour	4.50	15.00	70.00	318	8	3.70	.28	4.57	.....	.....
	Middlings (standard wheat)	6.00	.....	.....	319	8	3.73	.34	9.12	.....	.....
	Ground oats	4.50	.....	.....	254	8	3.65	.38	10.41	.....	.....

[1] Control taken as 100 per cent.

TABLE 7.—*Gains made in 4, 8, 11, and 14 days by broilers fed the control ration.*[1]

Experiment No.	Number of birds.	Average initial weight.	Amount gained in—						
			4 days.		8 days.		11 days.		14 days.
			Percentage of initial weight.	Percentage of total gain.	Percentage of initial weight.	Percentage of total gain.	Percentage of initial weight.	Percentage of total gain.	Percentage of initial weight.
		Ounces.							
1	12	26.0	20.05	31.55	35.91	56.52	47.23	74.33	63.54
2	12	28.6	20.27	33.71	35.94	59.77	47.46	79.83	60.13
3	12	28.4	14.82	25.12	32.09	54.39	45.31	76.80	59.00
4	12	28.5	19.64	36.08	34.77	63.88	46.42	85.28	54.43
5	12	25.9	16.35	30.21	27.98	51.69	37.78	69.79	54.13
6	12	26.0	16.52	30.57	30.12	55.74	41.30	76.42	54.04
7	12	28.6	17.31	33.43	35.34	68.25	44.70	86.33	51.78
8	12	28.5	14.63	28.90	31.45	62.12	49.50	78.02	50.63
Total	96								
Average			17.45	31.18	32.95	58.88	43.81	78.29	55.96
9	12	26.0	16.82	33.98	30.58	61.78	38.63	78.04	49.50
10	12	26.0	14.69	29.95	29.64	60.43	38.95	79.41	49.05
11	12	38.8	16.78	34.67	32.51	67.17	41.71	86.18	48.40
12	12	25.5	7.30	15.30	19.69	41.26	36.09	75.63	47.72
13	12	25.6	8.61	18.48	22.41	48.09	37.24	79.91	46.60
14	12	38.7	21.15	45.64	32.35	69.81	39.83	77.32	46.34
15	12	25.7	6.16	14.13	20.35	46.70	35.84	82.24	43.58
16	12	38.8	18.44	43.98	27.72	66.11	36.25	86.45	41.93
17	12	35.1	10.79	25.84	20.61	49.35	27.13	64.97	41.76
18	12	31.7	15.09	37.07	23.48	57.68	31.91	78.38	40.71
19	12	38.9	14.59	36.19	29.13	72.26	37.01	91.81	40.31
20	12	24.8	17.46	43.45	26.51	65.98	37.10	92.33	40.18
Total	144								
Average			13.99	31.32	26.25	58.76	36.47	81.64	44.67
21	12	30.9	10.04	25.13	22.36	55.96	30.45	76.20	39.96
22	12	34.7	11.77	29.57	23.48	58.99	31.72	79.70	39.80
23	12	36.4	9.06	24.83	17.80	47.78	25.15	68.92	36.49
24	12	35.8	10.49	28.76	22.14	60.70	26.54	72.77	36.47
25	12	30.9	9.94	27.29	19.54	53.65	26.15	71.80	36.42
26	12	30.8	11.00	30.47	21.24	58.84	28.90	80.06	36.10
27	12	24.8	6.33	17.86	11.12	31.37	26.04	73.48	35.44
28	12	30.9	8.82	25.95	16.58	48.78	24.29	71.46	33.99
29	12	31.7	10.58	31.78	18.77	56.38	24.41	73.33	33.29
30	12	22.6	12.56	38.08	19.04	57.63	25.93	78.48	33.04
31	12	28.6	11.83	36.78	18.24	56.70	24.35	75.69	32.17
32	12	31.0	8.20	25.55	19.10	59.52	26.68	83.14	32.09
33	12	36.4	8.11	25.38	15.62	48.89	22.57	73.77	31.95
34	12	24.8	12.20	38.70	20.08	63.71	28.38	90.04	31.52
35	12	31.1	8.82	28.73	18.75	61.07	20.50	66.78	30.70
Total	180								
Average			9.98	28.82	18.92	54.63	26.20	76.81	34.63
36	12	26.0	7.05	23.86	13.34	45.14	21.24	71.88	29.55
37	12	28.5	11.72	40.39	13.19	45.45	20.75	71.50	29.02
38	12	31.1	6.92	24.40	15.21	53.63	23.18	81.73	28.36
39	12	36.8	6.01	21.32	16.19	57.45	21.71	77.04	28.18
40	12	31.7	5.97	21.45	12.56	45.13	20.29	72.91	27.83
41	12	30.9	8.85	31.86	17.46	62.85	20.41	73.47	27.78
42	12	25.9	11.11	40.02	21.51	77.49	23.42	84.37	27.76
43	12	38.8	5.27	20.90	12.10	47.98	16.53	65.44	25.22
44	12	36.4	4.76	19.09	11.70	46.91	16.39	65.72	24.94
45	12	31.0	7.09	28.45	15.23	61.12	21.14	84.83	24.92
46	12	31.3	11.35	46.90	15.84	65.45	19.01	78.55	24.20
47	12	26.2	9.52	41.11	12.99	56.09	17.14	74.01	23.16
48	12	24.8	2.19	9.69	10.41	46.06	18.22	80.62	22.60
49	12	38.0	5.10	23.85	9.93	46.85	15.24	71.28	21.38
50	12	38.1	4.00	18.19	9.73	46.00	13.15	62.17	21.15
51	12	38.7	4.21	20.81	8.88	43.90	14.12	69.80	20.23
Total	192								
Average			6.95	27.37	13.52	53.25	18.87	74.32	25.39
Grand total	612								
Grand average			12.09	30.10	22.91	57.05	31.34	78.04	40.16

[1] Corn meal (40 parts)+butter milk (60 parts).

TABLE 8.—*Gains made in 4, 8, 11, and 14 days by springs fed the control ration.*[1]

Experiment No.	Number of birds.	Average initial weight.	Amount gained in—						
			4 days.		8 days.		11 days.		14 days.
			Percentage of initial weight.	Percentage of total gain.	Percentage of initial weight.	Percentage of total gain.	Percentage of initial weight.	Percentage of total gain.	Percentage of initial weight.
		Ounces.							
1	12	54.7	16.22	57.01	30.16	68.81	36.28	82.77	43.83
2	12	43.9	12.73	31.47	27.38	67.69	34.53	85.36	40.45
3	12	54.7	13.97	36.30	21.26	55.25	30.62	79.57	38.48
4	12	43.8	12.65	33.83	27.38	73.23	33.74	90.24	37.39
5	12	44.0	11.13	30.99	24.07	67.01	31.72	88.31	35.92
6	12	55.0	14.04	40.86	25.91	75.41	28.88	84.05	34.36
7	48	54.8	15.85	46.41	23.78	69.63	29.88	87.50	34.15
8	12	45.6	8.83	33.15	18.70	70.20	22.37	83.97	26.44
9	48	57.1	11.70	43.49	16.95	63.01	25.15	93.49	26.90
10	48	58.2	10.92	44.19	13.22	53.50	23.55	95.35	24.71
11	48	55.5	2.40	9.96	13.86	57.51	18.67	77.47	24.10
12	48	56.8	5.88	33.31	10.00	56.66	14.71	83.34	17.65
13	24	41.9	.....	.....	14.04	51.58	21.51	79.49	27.06
14	48	42.3	.....	.....	13.99	42.42	24.64	74.71	32.98
Total	396	.....	.....	.....	.....	.....	.....	.....	.....
Average	.....	.....	.....	.....	17.28	59.81	24.43	84.56	28.88

[1] Corn meal (40 parts) + buttermilk (60 parts).

TABLE 9.—*Gains made in 4, 8, 11, and 14 days by roasters fed the control ration.*[1]

Experiment No.	Number of birds.	Average initial weight.	Amount gained in—						
			4 days.		8 days.		11 days.		14 days.
			Percentage of initial weight.	Percentage of total gain.	Percentage of initial weight.	Percentage of total gain.	Percentage of initial weight.	Percentage of total gain.	Percentage of initial weight.
		Ounces.							
1	12	66.1	15.50	39.95	28.04	72.27	33.55	86.47	38.80
2	12	66.1	15.87	45.36	28.54	81.57	31.65	90.45	34.99
3	12	66.0	12.49	38.62	25.11	77.64	27.68	85.59	32.34
4	12	74.2	14.00	44.05	22.08	69.48	27.24	85.71	31.78
5	12	77.4	19.18	61.57	22.49	72.20	27.22	87.38	31.15
6	12	74.4	14.10	50.98	20.55	74.30	24.60	88.94	27.66
7	12	74.3	12.50	47.28	18.31	69.25	22.74	86.01	26.44
8	12	64.9	12.13	45.48	19.81	74.28	23.09	86.58	26.67
9	12	82.6	9.65	37.58	19.59	76.29	23.04	89.72	25.68
10	12	82.6	10.82	43.95	17.99	73.07	22.55	91.59	24.62
11	12	82.8	9.62	39.69	17.45	71.99	21.66	89.36	24.24
12	12	73.0	10.57	43.99	17.15	71.37	21.71	90.35	24.03
13	12	76.2	10.90	45.48	14.77	62.99	20.21	86.18	23.45
14	12	65.8	10.70	49.45	18.00	83.17	19.39	89.60	21.64
15	12	67.1	10.88	46.48	16.64	71.08	19.47	83.17	23.41
16	12	66.3	11.24	55.13	16.08	73.39	19.25	87.86	21.91
17	12	62.8	11.66	37.71	17.93	84.96	17.97	84.96	21.15
18	12	70.2	7.46	39.70	11.95	63.60	15.20	80.89	18.79
19	24	87.1	12.27	68.97	14.72	82.74	18.40	103.43	17.79
20	12	79.5	10.47	59.05	15.51	87.48	16.81	94.81	17.73
21	12	75.6	4.24	26.14	10.35	63.81	12.97	79.96	16.22
22	24	82.6	6.47	38.44	8.09	48.07	12.30	73.08	16.83
23	12	75.5	6.97	42.14	11.46	69.29	13.78	83.31	16.54
24	12	76.4	5.94	37.78	10.04	63.75	12.43	78.92	15.75
25	12	65.1	11.07	69.23	16.06	100.44	17.89	111.88	15.99
26	12	80.8	4.62	54.38	5.17	66.45	4.91	63.11	7.78
Total	336	.....	.....	.....	.....	.....	.....	.....	.....
Average	.....	.....	11.11	49.71	17.29	77.36	20.68	92.53	22.35

[1] Corn meal (40 parts) + buttermilk (60 parts).

TABLE 10.—*Gains made in 4, 8, 11, and 14 days by hens fed the control ration.*[1]

Experiment No.	Number of birds.	Average initial weight.	Amount gained in—						
			4 days.		8 days.		11 days.		14 days.
			Percentage of initial weight.	Percentage of total gain.	Percentage of initial weight.	Percentage of total gain.	Percentage of initial weight.	Percentage of total gain.	Percentage of initial weight.
		Ounces.							
1	12	66.8	10.22	47.45	15.84	73.54	19.87	92.25	21.54
2	12	77.2	9.26	35.18	15.55	58.89	21.59	82.03	26.32
3	12	70.8	7.88	39.48	13.51	67.69	16.64	83.37	19.96
4	12	78.6	6.91	35.80	11.20	68.03	15.55	80.57	19.30
5	12	72.1	4.54	24.25	10.67	56.98	12.50	66.77	18.72
6	12	79.1	12.85	72.27	16.84	94.71	15.13	85.10	17.78
7	12	79.5	3.62	22.57	9.47	59.04	12.68	79.05	16.04
8	12	66.5	3.51	22.30	8.52	54.13	13.39	85.07	15.74
9	12	70.3	1.01	64.17	9.87	62.71	14.98	95.17	15.74
10	12	69.6	6.24	40.00	12.94	82.95	11.16	71.54	15.60
11	12	78.7	4.23	27.99	8.46	55.99	12.76	84.45	15.11
12	12	78.7	5.55	33.41	8.94	53.83	12.86	77.06	16.61
13	12	81.6	9.70	69.58	12.68	90.96	12.46	89.38	13.94
14	12	70.2	3.30	25.98	10.18	80.16	8.55	67.32	12.70
15	12	83.6	3.15	24.90	7.92	62.61	11.49	90.83	12.65
16	12	78.6	4.19	32.66	7.39	57.60	12.15	94.70	12.83
17	12	66.3	1.63	13.59	4.54	37.92	8.12	67.69	12.00
18	12	78.7	5.18	46.46	7.34	65.83	10.17	91.21	11.15
19	12	84.6	3.24	29.67	6.13	56.14	5.93	54.30	10.92
20	12	69.8	6.09	57.13	6.93	65.01	8.76	82.18	10.66
21	12	79.5	—1.32	.....	2.51	24.23	6.77	65.35	10.36
22	12	84.6	—1.02	.....	4.13	40.25	6.43	62.67	10.26
23	12	78.7	3.34	32.30	6.93	67.02	10.84	104.84	10.34
24	12	78.4	6.05	60.62	9.85	98.70	12.62	126.45	9.98
25	12	82.5	1.61	16.48	5.16	52.81	7.66	78.40	9.77
26	12	81.5	8.76	90.31	11.34	116.91	10.33	106.49	9.70
27	12	93.5	6.18	69.44	8.34	93.71	7.21	81.01	8.90
28	12	78.9	2.62	31.49	2.87	34.50	8.55	102.76	8.32
29	12	81.8	1.66	23.71	4.27	61.00	5.17	73.85	7.00
30	12	78.6	1.66	23.85	4.07	58.48	7.82	112.36	6.96
31	12	85.4	1.81	26.62	6.68	98.24	5.98	87.94	6.80
32	12	85.0	3.15	48.46	7.50	115.38	5.19	79.85	6.50
33	12	79.2	6.78	.....	3.10	46.83	8.22	124.17	6.62
34	12	92.9	1.24	19.77	3.99	63.62	3.30	36.37	6.26
35	12	78.9	2.62	31.49	2.87	34.50	8.55	102.76	8.32
36	12	78.7	1.44	28.07	.55	10.72	3.52	68.62	5.13
37	12	82.18	1.09	30.03	2.77	76.31	3.16	87.05	3.63
38	12	85.4	.98	53.85	2.75	151.10	7.58	86.81	1.82
Total	456	.....	.....	.....	.....	.....	.....	.....	.....
Average	.....	.....	4.08	34.31	7.75	65.18	9.99	84.02	11.89

[1] Corn meal (40 parts)+buttermilk (60 parts).

TABLE 11.—*Weight lost in dressing poultry before feeding.*

BROILERS.

Experiment No.	Number of birds.	Average weight of birds.			Percentage of final weight lost as—				Cooler loss as percentage of dressed weight.
		Final live.	Dressed.	Chilled.	Blood.	Feathers.	Cooler loss.	Total.	
		Ounces.	*Ounces.*	*Ounces.*					
1	6	26.3	23.4	23.2	3.97	7.16	0.76	11.89	0.85
2	6	29.1	26.1	25.8	3.73	6.76	1.00	11.49	1.11
3	6	25.2	22.5	22.3	4.27	6.33	.71	11.31	.78
4	6	31.7	28.5	28.2	4.23	5.99	.79	11.01	.89
5	6	35.4	31.8	31.6	3.61	6.43	.51	10.55	.57
6	6	28.7	25.8	25.6	4.24	5.68	.80	10.72	.89
7	6	44.1	38.5	38.2	4.82	7.89	.83	13.54	.95
8	6	38.0	33.4	33.2	4.32	7.75	.60	12.67	.69
9	6	26.1	23.6	23.6	3.90	5.92		9.75	
10	12	30.8	27.8	27.3	3.76	5.72	1.65	11.13	1.83
11	12	30.5	27.2	27.0	3.60	7.25	.57	11.42	.65
12	6	37.5	34.0	33.9	3.76	5.41	.40	9.57	.43
13	12	30.7	27.5	27.4	4.11	6.56	.28	10.95	.31
14	12	29.6	26.4	26.0	4.08	6.66	.43	12.17	.49
15	6	40.7	36.1	35.7	4.83	6.57	1.08	12.48	1.22
16	6	33.9	30.1	29.8	3.39	7.90	.69	11.98	.78
17	6	30.5	26.8	26.7	4.15	7.91	.28	12.34	.33
Total	126								
Average		30.8	28.5	28.3	4.02	6.67	.68	11.37	.76

SPRINGS.

1	6	54.8	47.7	47.5	4.70	8.23	0.43	13.36	0.51
2	6	66.0	58.5	57.8	4.06	7.40	1.04	12.50	1.18
Total	12								
Average		60.4	53.1	52.6	4.38	7.81	.74	12.93	.85

ROASTERS.

1	6	82.7	72.2	72.0	4.05	8.65	0.19	12.89	0.22
2	6	74.3	65.2	64.9	4.05	8.20	.37	12.62	.42
3	6	67.2	59.2	58.9	3.46	8.40	.52	12.38	.60
Total	18								
Average		74.7	65.5	65.4	3.85	8.42	.36	12.63	.41

HENS.

1	6	73.8	67.5	67.2	3.28	5.23	0.36	8.87	0.39
2	6	92.3	85.2	85.0	2.37	5.55	.18	7.88	.20
3	6	74.0	68.0	67.7	3.61	4.56	.33	8.50	.35
4	6	82.1	74.9	74.7	2.80	5.98	.24	9.02	.27
5	6	81.0	73.6	72.7	3.55	5.63	.25	9.43	.27
6	6	74.3	67.8	67.5	3.78	4.92	.41	9.11	.45
7	6	85.3	77.4	77.2	3.88	5.37	.25	9.50	.27
8	6	69.0	62.9	62.5	3.54	5.37	.44	9.35	.48
Total	48								
Average		79.0	72.1	71.8	3.35	5.33	.31	8.99	.34

TABLE 12.—*Weight lost in dressing poultry fed the control ration.*[1]

BROILERS.

Experiment No.	Number of birds.	Average weight of birds.			Percentage of final live weight lost as—				Cooler loss as percentage of dressed weight.
		Final live.	Dressed.	Chilled.	Blood.	Feathers.	Cooler loss.	Total.	
		Ounces.	*Ounces.*	*Ounces.*					
1	12	33.7	30.5	30.2	3.96	5.66	1.00	10.62	1.11
2	12	37.8	34.1	33.8	4.30	5.66	.74	10.70	.82
3	12	45.7	41.1	40.7	3.77	6.35	.97	11.09	1.08
4	6	60.2	53.7	53.4	4.07	6.72	.45	11.24	.50
5	6	55.1	49.0	48.7	4.07	7.00	.43	11.59	.48
6	12	38.4	35.1	34.6	3.74	4.89	1.28	9.91	1.40
7	12	38.6	35.0	34.5	3.23	6.36	1.36	10.95	1.50
8	12	34.0	33.4	33.4	4.60	5.36	.18	10.14	.19
9	12	47.0	42.3	41.8	3.91	6.16	1.03	11.10	1.15
10	12	41.8	37.3	37.0	4.02	6.75	.70	11.47	.79
11	12	34.8	30.9	30.4	4.18	7.22	1.14	12.54	1.29
12	4	41.9	37.8	37.5	4.11	5.68	.63	10.42	.70
13	4	49.8	44.4	44.0	5.23	5.58	.79	11.60	.89
14	4	36.2	32.4	32.1	3.53	6.94	.86	11.33	.95
Total	132								
Average		41.1	37.2	36.8	4.01	6.45	.87	11.33	.97

SPRINGS.

1	12	73.8	64.9	64.5	4.06	8.06	0.52	12.64	0.59
2	12	89.3	78.6	78.2	4.48	7.49	.41	12.38	.48
Total	24								
Average		81.5	71.7	71.4	4.27	7.78	.47	12.52	.54

ROASTERS.

1	12	102.9	91.0	90.5	4.05	7.50	0.44	11.99	0.51
2	12	94.9	85.6	84.9	4.16	5.67	.74	10.57	.81
3	4	77.8	68.4	68.1	4.25	7.77	.39	12.41	.45
Total	28								
Average		95.9	85.5	84.9	4.13	6.75	.56	11.44	.63

HENS.

1	11	85.2	78.8	78.4	3.20	4.31	0.42	7.92	0.45
2	12	101.5	93.6	93.1	3.26	4.54	.45	8.25	.48
3	12	69.8	63.8	63.7	3.28	5.20	.21	8.69	.23
4	11	87.1	79.2	79.0	3.46	5.68	.20	9.34	.21
5	12	92.4	85.3	85.1	3.02	4.70	.21	7.93	.22
6	12	82.6	76.4	76.2	3.56	4.02	.21	7.79	.23
7	12	87.2	80.0	79.4	2.96	5.29	.63	8.88	.70
8	12	77.2	70.6	70.5	3.40	5.07	.40	8.87	.44
Total	95								
Average		85.4	78.4	78.2	3.27	4.85	.34	8.46	.37

[1] Corn meal (40 parts) + buttermilk (60 parts).

TABLE 13.—*Distribution of weight of poultry before feeding.*

BROILERS.

Experiment No.	Number of birds.	Total.	Chilled weight.								
			Meat.	Skin.	Gizzard fat.	Edible organs.	Eggs.	Total edible.	Offal.	Bones.	Total inedible.
		Ozs.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
1	6	23.2	38.98	7.38	1.26	6.83	.....	54.45	27.76	17.79	43.55
2	6	25.8	43.66	7.42	1.20	6.54	.....	58.82	24.36	16.82	41.18
3	6	22.3	40.11	7.75	.90	7.80	.....	56.56	26.77	16.66	43.44
4	6	28.2	41.55	8.23	2.08	6.56	.....	58.42	25.40	16.17	41.58
5	6	31.6	43.73	6.96	.79	6.17	.....	57.65	24.68	17.67	42.35
6	6	25.6	39.19	8.27	1.10	6.86	.....	55.42	25.92	18.66	44.58
7	6	38.2	41.68	7.77	.99	6.85	.....	56.30	25.21	17.50	43.70
8	6	33.2	42.94	6.99	.58	7.50	.....	57.43	25.02	16.96	42.57
9	6	23.6	38.01	7.96	1.55	7.47	.....	54.99	29.02	15.98	45.01
10	6	27.4	40.94	6.82	1.11	7.37	.....	56.21	27.01	16.78	43.79
11	6	27.7	40.98	6.87	.91	6.58	.....	55.34	26.36	18.30	44.66
12	6	33.9	40.50	7.63	1.75	6.56	.....	56.44	25.89	17.67	43.56
13	6	26.0	43.63	7.02	1.00	6.84	.....	58.49	25.67	15.83	41.51
14	6	24.2	36.24	6.65	.74	7.21	.....	50.84	26.96	22.21	49.16
15	6	35.7	35.84	8.21	2.68	6.52	.....	53.24	32.71	14.04	46.76
16	6	44.0	40.43	7.20	.78	6.07	.....	54.48	22.11	23.39	45.52
17	6	21.7	38.63	6.94	1.39	6.55	.....	53.51	27.12	19.37	46.49
18	6	29.8	41.46	10.13	2.95	5.62	.....	60.16	22.06	17.78	39.84
19	6	26.7	38.95	7.05	1.10	7.76	.....	54.86	27.55	17.59	45.14
Total	114	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Average	.....	28.9	40.39	7.54	1.31	6.82	.....	56.06	26.19	17.75	43.94

SPRINGS.

1	6	47.5	46.43	7.89	6.46	0.80	.....	61.58	22.15	16.28	38.43
2	6	57.8	45.40	9.73	5.43	3.06	.....	63.62	21.15	15.24	36.39
Total	12	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Average	.....	52.6	45.92	8.81	5.95	1.93	.....	62.61	21.65	15.76	37.41

ROASTERS.

1	6	72.0	44.48	11.07	5.02	4.44	.....	65.01	19.41	15.55	34.99
2	6	64.9	43.36	10.26	5.89	3.89	.....	63.40	21.48	15.11	36.60
3	6	58.9	44.32	7.12	6.13	.68	.....	58.25	23.98	17.78	41.75
Total	18	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Average	.....	62.3	44.05	9.48	5.68	3.00	.....	62.21	21.62	16.15	37.77

HENS.

1	6	67.2	40.19	13.67	9.62	4.81	1.95	70.24	18.75	11.02	29.77
2	6	85.0	39.05	13.35	11.71	4.94	2.57	71.62	18.25	10.20	28.45
3	6	67.7	36.77	15.79	12.08	4.26	4.25	73.15	16.66	10.19	26.85
4	6	74.7	37.80	14.98	8.23	4.89	3.45	69.35	18.94	11.72	30.64
5	6	72.7	39.16	14.71	10.37	4.55	1.63	70.42	18.52	11.05	29.57
6	6	67.5	39.31	13.33	7.94	5.64	1.76	67.98	20.45	11.57	32.02
7	6	77.2	38.55	15.62	10.88	4.57	2.05	71.67	17.03	11.28	28.31
8	6	62.5	40.09	16.01	8.09	4.74	1.36	70.29	17.92	11.78	29.70
Total	48	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Average	.....	70.1	38.87	14.68	9.87	4.80	2.38	70.59	18.32	11.10	29.42

TABLE 14.—*Distribution of weight of poultry fed the control ration.*[1]

BROILERS.

Experiment No.	Number of birds.	Total.	Chilled weight.								
			Meat.	Skin.	Gizzard fat.	Edible organs.	Eggs.	Total edible.	Offal.	Bones.	Total inedible.
		Ozs.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
1	4	30.2	43.02	7.63	4.57	5.81	.....	61.03	23.46	15.51	38.97
2	4	33.8	42.15	7.26	2.40	6.54	.....	58.35	25.29	16.35	41.64
3	4	40.7	38.60	14.01	5.92	6.38	.....	64.91	21.12	13.97	45.09
4	4	34.6	37.98	11.40	5.38	6.41	.....	61.17	23.38	15.44	38.82
5	4	34.1	36.36	11.30	4.84	6.46	.....	58.97	24.67	16.36	41.03
6	4	37.0	40.97	8.07	2.98	7.28	.....	59.30	24.83	16.87	40.70
7	4	41.3	38.47	10.98	4.54	6.53	.....	60.52	22.98	16.50	39.48
8	4	41.8	39.05	12.59	4.68	7.13	.....	63.44	21.91	14.65	36.56
9	4	28.5	39.57	8.84	3.40	6.83	.....	58.64	24.63	16.71	41.34
10	4	36.3	36.36	10.81	5.01	6.97	.....	59.15	24.43	16.42	40.85
11	4	37.5	36.48	12.52	3.61	5.84	.....	58.45	24.09	17.46	41.55
12	4	25.7	39.64	8.91	3.65	6.63	.....	58.83	23.64	17.54	41.18
13	4	44.1	39.51	9.51	3.90	6.12	.....	59.04	24.90	16.06	40.96
14	4	32.1	37.90	11.93	4.11	6.52	.....	60.46	24.00	15.54	39.54
Total	56	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Average	.....	35.6	39.00	10.41	4.21	6.53	.....	60.15	23.81	16.10	39.91

SPRINGS.

1	4	64.5	43.28	13.22	5.57	3.91	.....	65.98	20.77	13.25	34.02
2	4	78.2	42.91	13.07	5.49	6.67	.....	68.14	19.14	12.71	31.86
Total	8	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Average	.....	71.4	43.10	13.15	5.53	5.29	.....	67.07	19.96	12.98	32.94

ROASTERS.

1	4	84.9	40.35	13.60	7.60	5.18	.....	66.73	18.41	14.85	33.26
2	4	68.1	40.85	11.61	3.95	5.69	.....	62.10	22.55	15.35	37.90
Total	8	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Average	.....	76.5	40.60	12.61	5.81	5.44	.....	64.46	20.48	15.10	35.58

HENS.

1	4	78.4	37.96	14.14	12.37	6.09	2.06	72.62	18.05	9.32	27.37
2	4	93.1	36.23	14.40	11.92	4.56	3.40	70.51	18.36	11.12	29.48
3	4	63.7	38.65	16.22	9.97	5.30	1.35	71.49	18.76	9.73	28.49
4	4	79.0	38.41	16.51	8.93	6.42	1.57	71.84	18.23	9.87	28.16
5	4	85.1	37.73	13.92	10.73	4.68	4.25	71.31	18.04	10.70	28.74
6	4	76.2	36.59	15.35	11.03	4.40	4.11	71.48	17.49	11.04	28.53
7	4	79.4	39.13	13.58	9.57	4.63	3.68	70.59	19.02	10.37	29.39
8	4	70.3	38.75	13.22	9.50	5.60	4.27	71.34	19.39	9.26	28.65
Total	32	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Average	.....	78.2	37.93	14.67	10.50	5.21	3.09	71.40	18.43	10.18	28.61

[1] Corn meal (40 parts) + buttermilk (60 parts).

TABLE 15.—*Composition of poultry before feeding.*

BROILERS.

Experiment No.	Number of birds.	Meat.			Skin.			Edible viscera.			Crude gizzard fat.	
		Water.	Fat.	Protein.	Water.	Fat.	Protein.	Water.	Fat.	Protein.	Water.	Fat.
		Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
1	6	75.41	3.02	19.88	58.15	23.98	16.88	72.43	2.26	20.19	32.00	60.74
2	6	75.70	2.37	20.38	59.07	22.12	17.63	73.96	2.52	19.88	27.53	65.61
3	6	75.57	1.79	20.63	61.26	17.49	19.88	74.73	2.01	20.75	41.57	47.16
4	6	75.16	3.78	20.06	53.43	28.78	16.75	74.00	3.25	18.50	29.87	60.99
5	6	75.00	3.03	21.00	54.88	25.25	18.25	73.73	2.82	18.56	20.47	72.81
6	6	74.63	3.61	21.19	57.96	24.86	16.88	75.46	2.68	20.63	29.26	64.08
7	6	74.46	3.42	21.63	56.40	25.33	17.44	75.21	2.55	21.00	35.77	54.57
8	6	75.64	2.17	21.19	60.93	17.42	20.50	75.22	2.11	20.88	37.80	51.14
9	6	74.89	2.58	21.94	57.45	22.72	19.19	73.83	3.53	20.56	36.84	50.49
10	6	72.97	3.53	22.63	43.76	41.69	14.25	74.64	2.35	19.75	11.31	87.03
11	6	74.82	3.91	21.31	56.87	25.00	18.00	75.12	4.00	19.19	40.16	45.86
Total	66											
Average		74.93	3.02	21.08	56.33	24.97	17.79	74.39	2.73	19.99	31.14	60.04

SPRINGS.

1	6	73.52	2.30	22.38	55.06	24.54	19.31	74.33	1.69	20.09	29.40	61.41
2	6	72.73	3.66	21.69	44.96	38.61	15.13	73.92	2.23	20.75	11.12	85.17
Total	12											
Average		73.13	2.98	22.04	50.01	31.58	17.22	74.13	1.96	20.42	20.26	73.29

ROASTERS.

1	6	72.38	3.98	21.94	40.48	45.79	13.51	73.84	2.72	20.84	9.80	87.94
2	6	72.25	4.71	21.60	43.79	41.04	14.24	73.30	3.20	20.55	14.14	83.00
3	6	75.01	2.07	21.69	61.57	18.24	20.06	75.32	2.06	20.06	44.94	42.00
Total	18											
Average		73.21	3.59	21.76	48.61	35.02	15.94	74.15	2.66	20.48	22.96	70.98

HENS.

1	6	70.54	7.30	20.94	27.90	62.54	8.69	72.76	6.08	19.56	8.99	89.17
2	6	69.23	8.33	20.88	25.77	63.73	9.38	69.10	9.19	18.13	8.43	89.54
3	6	68.94	8.14	21.31	24.66	66.97	6.88	72.34	5.12	19.81	8.92	88.94
4	6	70.30	6.76	22.00	27.16	62.20	10.63	70.58	6.44	20.38	8.56	89.15
5	6	70.03	6.68	21.25	27.69	62.23	10.19	71.51	5.26	20.25	10.52	86.58
6	6	71.10	5.18	21.88	34.35	53.97	11.44	69.70	8.03	18.69	12.76	81.51
7	6	70.22	7.41	21.31	29.84	60.42	9.50	70.40	7.61	18.63	12.28	84.56
8	6	72.36	5.38	21.75	32.23	58.58	10.63	72.04	6.29	19.00	11.39	88.88
Total	48											
Average		70.34	6.90	21.41	28.70	61.33	9.67	70.99	6.75	19.31	10.23	87.29

TABLE 16.—*Composition of poultry fed the control ration.*[1]

BROILERS.

Experiment No.	Number of birds.	Meat.			Skin.			Edible viscera.			Gizzard fat.		
		Water.	Fat.	Protein.	Water.	Fat.	Protein.	Water.	Fat.	Protein.	Water.	Fat.	Protein.
		Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
1	4	71.79	6.76	19.56	33.20	56.69	9.44	69.48	5.75	19.00	11.48	86.25	2.27
2	4	72.83	6.16	19.00	35.46	47.63	12.75	73.98	3.61	18.00	11.37	87.98	2.25
3	4	73.42	5.73	20.38	41.02	45.98	12.13	75.04	2.66	18.75	14.00	83.32	3.38
4	4	72.72	6.57	17.25	44.83	40.42	13.31	74.82	3.01	18.63	23.68	69.39	5.13
5	4	73.66	5.00	19.13	39.50	47.78	12.50	74.60	3.36	19.81	13.00	81.69	2.56
6	4	73.56	4.56	21.55	38.66	49.40	11.81	74.81	3.31	19.69	18.87	78.43	4.13
7	4	71.97	7.73	20.75	48.10	36.12	14.69	74.84	3.44	20.13	16.61	78.87	3.97
8	4	71.02	8.04	20.13	43.25	43.59	13.00	73.85	4.78	18.44	15.48	81.11	3.19
9	4	73.61	4.90	20.69	39.87	47.38	11.25	75.35	3.09	20.50	14.52	82.26	3.75
10	4	70.62	8.95	20.06	41.68	45.17	12.81	75.65	3.29	19.44	13.57	83.02	3.31
11	4	74.30	4.61	20.63	48.31	37.70	13.56	75.21	3.68	19.44	15.15	81.88	3.06
12	4	73.87	4.75	20.56	37.66	51.64	11.94	75.17	3.00	19.56	13.88	85.60	3.25
Total	48												
Average		72.78	6.15	19.97	40.96	45.80	12.43	74.40	3.58	19.28	15.14	81.65	3.35

SPRINGS.

1	4	73.20	4.69	20.54	38.41	49.53	11.69	73.81	3.30	18.18	13.67	83.49	
2	4	72.94	4.73	20.87	36.94	51.70	10.46	75.55	3.70	19.11	11.23	86.28	
Total	8												
Average		73.07	4.71	20.76	37.68	50.67	11.08	73.68	3.50	18.65	12.45	84.89	

ROASTERS.

1	4	71.89	6.11	20.94	38.22	49.86	11.75	73.88	3.31	20.25	10.34	88.03	
2	4	72.38	5.86	19.50	42.67	43.49	12.56	73.73	4.24	18.94	14.68	81.87	
Total	8												
Average		72.14	5.99	20.22	40.45	46.68	12.16	73.81	3.78	19.60	12.51	84.95	

HENS.

1	4	69.29	8.21	21.75	27.95	63.11	8.81	64.39	15.55	16.94	9.32	88.85	
2	4	70.02	7.35	21.38	26.89	63.72	9.31	70.92	10.02	18.44	19.39	77.98	
3	4	71.52	7.06	19.50	30.48	60.48	10.69	66.58	12.21	17.69	12.93	85.83	
4	4	70.65	7.56	20.38	30.26	60.41	9.19	66.98	11.65	16.06	12.44	84.81	
5	4	71.50	6.17	21.00	28.90	63.09	9.81	65.30	15.09	16.38	10.73	86.88	
6	4	68.49	8.24	22.38	25.54	65.60	9.25	68.46	8.69	19.25	8.10	87.77	
7	4	70.38	6.90	21.38	27.95	61.19	11.31	67.41	11.79	17.56	8.35	80.47	
8	4	69.92	7.09	21.31	30.35	60.12	10.19	65.00	14.90	17.13	8.39	91.31	
Total	32												
Average		70.22	7.32	21.14	28.54	62.22	9.82	66.88	12.50	17.43	11.21	85.50	

[1] Corn meal (40 parts)+buttermilk (60 parts).

DISCUSSION OF RESULTS.

EFFECTS OF RATIONS ON DIFFERENT CLASSES OF BIRDS.

Broilers fed the rations containing a protein concentrate, such as peanut meal, coconut meal, soy-bean meal, or meat scrap (Table 2), made appreciably better gains than those given the control ration of corn meal and buttermilk. In the majority of cases the other rations proved of less value than the control ration. As they grow rapidly,

broilers require feeds containing tissue-forming substances. For this reason the rations containing the protein concentrates undoubtedly proved valuable, a conclusion supported also by the data in Table 3. Experiments 17 to 26 in Table 3 were conducted on Leghorn broilers, using the "house run" of birds in a commercial feeding plant in San Francisco, Calif. Each lot comprised more than a thousand birds. Rations 17 to 20 produced very good results, particularly those containing sesame-seed meal and soy-bean meal. Here again the value of protein concentrates in rations for broilers is evident.

With the exception of No. 6, all the rations fed the "springs" (Table 4) were made up, for the most part, of corn, low-grade flour, standard wheat middlings, oat products, and other feedstuffs commonly used for poultry fleshing. These rations were uniformly successful. In view of the results secured with ration 6, containing peanut meal, which are better than those obtained from the five other rations, it would seem that springs also respond readily to a ration containing suitable protein concentrates.

The results obtained in feeding hens differed from those obtained in feeding immature birds. The gains made by the hens were small and erratic, because of the more variable physical condition in which they were received by the packer. A comparison of the results of the small-scale experiments on peanut meal, soy-bean meal, and meat scrap (Table 5) with those in which the control ration was fed shows that the addition of a protein concentrate does not improve the value of the control ration for hens. As further indicated by the battery experiments (Table 6), hens under packing-house conditions gain about as much on corn meal or cheaper substitutes and buttermilk as on more expensive rations containing protein concentrates.

EFFECT OF LENGTH OF FEEDING PERIOD ON DIFFERENT CLASSES OF BIRDS.

In deciding the number of days that birds should be fed, the packer must consider the rate of growth of the different classes, the desired appearance of the dressed product, and the overhead expense of holding the birds. He is also influenced to a great extent by the market premium offered for certain weights of broilers and roasters. In addition, he should take into account the character of the gains produced. Broilers, springs, and roasters grow rapidly and may be expected to put on muscle and fat tissue during the feeding period, whereas hens put on a much larger proportion of fat. Exact information on this question has been obtained in a series of experiments, details of the results of which are reported in Tables 7 to 10, inclusive. Tables 17, 18, and 19 give a summary of these data.

TABLE 17.—*Character of gains made by different classes of birds fed the control ration.*

Class.	Number.	Water.	Protein.	Lean meat (water and protein).	Fat.	Ratio of protein to fat.	Ratio of lean meat to fat.
		Ounces.	*Ounces.*	*Ounces.*	*Ounces.*		
Broilers	114	4.9	1.2	6.1	3.6	1 : 3.0	1 : 0.58
Springs	20	5.3	1.6	6.9	4.8	1 : 3.0	1 : .69
Roasters	26	4.9	.7	5.6	4.4	1 : 6.3	1 : .79
Hens	80	2.3	.4	2.7	4.4	1 : 11.0	1 : 1.63

The high proportion of fat added by hens explains the feeding results which indicate that protein concentrates are not essential in rations for hens (p. 18).

TABLE 18.—*Gains made in 4, 8, 11, and 14 days by different classes of birds fed the control ration.*

Class.	Number.	Gain in 4 days.		Gain in 8 days.		Gain in 11 days.		Gain in 14 days.
		Percentage of initial weight.	Percentage of total gain.	Percentage of initial weight.	Percentage of total gain.	Percentage of initial weight.	Percentage of total gain.	Per centage of initial weight.
Broilers	612	12.09	30.10	22.91	57.05	31.34	78.04	40.16
Springs	396	.....	.....	17.28	59.81	24.43	84.56	28.88
Roasters	336	11.11	49.71	17.29	77.36	20.68	92.53	22.35
Hens	456	4.08	34.31	7.75	65.18	9.99	84.02	11.89

The average daily gains made by broilers in the different periods are 3.02, 2.71, 2.81, and 2.94 per cent, respectively. In other words, these broilers continued to add weight very rapidly throughout the feeding period. In 11 days they had made only 78.04 per cent of their total gain. It thus appears that from the standpoint of the amount of gain made, a 14-day feeding period is not too long.

TABLE 19.—*Gains made by broilers during different feeding periods.*

Number of birds.	Marginal gain.	Gain in 4 days.		Gain in 8 days.		Gain in 11 days.		Gain in 14 days.
		Percentage of initial weight.	Percentage of total gain.	Percentage of initial weight.	Percentage of total gain.	Percentage of initial weight.	Percentage of total gain.	Percentage of initial weight.
	Per cent.							
96	50	17.45	31.18	32.95	58.88	43.81	78.29	55.96
144	40 to 50	13.99	31.32	26.25	58.76	36.47	81.64	44.67
180	30 to 40	9.98	28.82	18.92	54.63	26.20	76.81	34.63
192	20 to 30	6.95	27.37	13.52	53.25	18.87	74.32	25.39
612	Average.	12.09	30.10	22.91	57.05	31.34	78.04	40.16

Birds which make small gains in the beginning show small gains at the end, probably because of their physical condition (Table 19).

The average daily gains made by springs in the different periods are 2.14 per cent during the first 8 days, 2.38 per cent from the ninth to eleventh day, inclusive, and 1.48 per cent during the last period. These results show that springs grow very rapidly during the first 11 days, and, although their growth is less rapid during the last period, they still make a fairly good gain.

The roasters made an average daily gain in the different periods of 2.78, 1.55, 0.80, and 0.56 per cent, respectively. Thus their most rapid gain occurred during the first 4 days, the daily gain during the second 4 days being fairly rapid, but very small during the rest of the time.

As previously noted, a large part of the gains made by hens is in the form of fat. Moreover, the gains are small and erratic. The average percentage daily gains made by these hens during the different periods of feeding were 1.02, 0.92, 0.75, and 0.63 per cent, respectively. These small gains, with their high content of fat, indicate that the customary practice of feeding hens for only 6 to 8 days is well founded.

COMPOSITION OF POULTRY BEFORE AND AFTER FEEDING.

The various rations, differing in quality though containing all the essential nutrients, had no consistent effect upon the losses in dressing and chilling nor upon the percentage composition of birds of the same class. Broilers, springs, roasters, and hens, each considered as a class, exhibited marked differences, however. Since a ration consisting of corn meal (40 parts) and buttermilk (60 parts) was used with each experimental ration as a control, more data were accumulated with it than with any of the others. The results obtained with the control ration only, therefore, are presented in detail to show the differences in composition and dressing losses of the four classes of birds.

WEIGHT LOST IN DRESSING.

Table 20 gives a summary of the results of the experiments on the medium-weight breeds, including Rhode Island Reds, Plymouth Rocks, and Wyandottes, to determine the amount lost by the various classes during dressing (Tables 11 and 12).

TABLE 20.—*Weight lost by range and fed birds during dressing.*

Class.	Number.	Average weight.			Percentage of final live weight lost as—				Cooler loss (percentage of dressed weight)
		Final live.	Dressed.	Chilled.	Blood.	Feathers.	Cooler loss.	Total shrinkage.	
		Ounces.	*Ounces.*	*Ounces.*					
Range:									
Broilers	126	30.8	28.5	28.3	4.02	6.67	0.68	11.37	0.76
Springs	12	60.4	53.0	52.6	4.38	7.81	.74	12.93	.85
Roasters	18	74.7	65.5	65.3	3.85	8.42	.36	12.63	.41
Hens	48	79.0	72.1	71.8	3.35	5.33	.31	8.99	.34
Fed:									
Broilers	132	41.1	37.1	36.8	4.01	6.45	.87	11.33	.97
Springs	24	81.5	71.7	71.4	4.27	7.78	.47	12.52	.54
Roasters	28	95.9	85.5	84.9	4.13	6.75	.56	11.44	.63
Hens	95	85.4	78.4	78.2	3.27	4.85	.34	8.46	.37

The data presented on springs and roasters are somewhat limited. The total percentage shrinkage for broilers, springs, and roasters was fairly constant both before and after feeding. The shrinkage in the case of hens was much less than that obtained with other types of birds.

DISTRIBUTION OF WEIGHT.

The birds used for obtaining the shrinkage data were dissected, with the results shown in Tables 13 and 14 and summarized in Table 21.

TABLE 21.—*Distribution of weight in range and fed birds.*

Class.	Number.	Percentage of chilled weight.								
		Meat.	Skin.	Crude gizzard fat.	Edible organs.	Eggs.	Total edible.	Offal.	Bones.	Total inedible.
Range:										
Broilers	114	40.39	7.54	1.31	6.82	.....	56.06	26.19	17.75	43.94
Springs	12	45.92	8.81	5.95	1.93	.....	62.61	21.65	15.76	37.41
Roasters	18	44.05	9.48	5.68	3.00	.....	62.21	21.62	16.15	37.77
Hens	48	38.87	14.68	9.87	4.80	2.38	70.59	18.32	11.10	29.42
Fed:										
Broilers	56	39.00	10.41	4.21	6.53	.....	60.15	23.81	16.10	39.91
Springs	8	43.10	13.15	5.53	5.29	.....	67.07	19.96	12.98	32.94
Roasters	8	40.60	12.61	5.81	5.44	.....	64.46	20.48	15.10	35.58
Hens	32	37.93	14.67	10.50	5.21	3.09	71.40	18.43	10.18	28.61

As they reached the feeding house the range broilers contained on the average 56.06 per cent of edible parts, whereas springs, roasters, and hens contained 62.61, 62.21, and 70.59 per cent, respectively. Thus the proportion of edible portion is much higher in the mature than in the immature birds. After feeding, this difference decreases, and broilers, springs, roasters, and hens have 60.15, 67.07, 64.46, and 71.40 per cent of edible portion, respectively. The results also show that hens have a larger amount of crude gizzard fat than other classes.

COMPOSITION OF RANGE AND FED BIRDS.

The results of the chemical analyses made on the birds, given in detail in Tables 15 and 16, are summarized in Table 22.

TABLE 22.—*Composition of range and fed birds.*

Class.	Number.	Meat.			Skin.			Edible viscera.			Crude gizzard fat.	
		Water.	Fat.	Protein.	Water.	Fat.	Protein.	Water.	Fat.	Protein.	Water.	Fat.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Range:												
Broilers	66	74.93	3.02	21.08	56.33	24.97	17.79	74.39	2.73	19.99	31.14	60.04
Springs	12	73.13	2.98	22.04	50.01	31.58	17.22	74.13	1.96	20.42	20.26	73.29
Roasters	18	73.21	3.59	21.76	48.61	35.02	15.94	74.15	2.66	20.48	22.96	70.98
Hens	48	70.34	6.90	21.41	28.70	61.33	9.67	70.99	6.75	19.31	10.23	87.29
Fed:												
Broilers	48	72.78	6.15	19.97	40.96	45.80	12.43	74.40	3.58	19.28	15.14	81.65
Springs	8	73.07	4.71	20.76	37.68	50.67	11.08	73.68	3.50	18.65	12.45	84.89
Roasters	8	72.14	5.99	20.22	40.45	46.68	12.16	73.81	3.78	19.60	12.51	84.95
Hens	32	70.22	7.32	21.14	28.54	62.22	9.82	66.88	12.50	17.43	11.21	85.50

The data in Table 22 and the results secured from dissecting the same birds gave the results reported in Table 23, showing the composition of the total edible portions of various classes of chickens before and after feeding.

TABLE 23.—*Composition of total edible portion of chickens before and after feeding.*

Class.	Total edible portion.					
	Water.		Fat.		Protein.	
	Before feeding.	After feeding.	Before feeding.	After feeding.	Before feeding.	After feeding.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Broilers	70.87	63.39	7.23	16.91	20.11	17.44
Springs	68.07	62.06	12.03	20.26	18.50	17.22
Roasters	64.96	61.60	16.55	21.90	17.33	14.42
Hens	51.95	50.67	29.26	32.18	17.00	14.94

COMPOUNDING RATIONS.

A great variety of feeds were used in the various rations in order to obtain data on their relative value for poultry fleshing (Table 1). Equally satisfactory results apparently can be obtained by the use of different feedstuffs as well as by the use of different combinations of the same feeds. It is possible to choose from a wide range of feeds which have practically the same fleshing value in a ration. This is fortunate, since it permits the feeder to adapt his ration to market conditions by taking advantage of special prices of certain feeds and also to use feeds available locally.

In the selection of feeds to compose a ration, certain cardinal principles must be remembered. The first consideration is the class of bird to be fed. A growing bird, such as a broiler or spring, requires a ration of quite a different composition from that needed by a mature hen, which responds chiefly to fat production. From the standpoint of the gains made, a simple fattening ration of corn meal and buttermilk is about as good as any other ration for hens.

As chickens are unable to utilize large amounts of roughage in securing their nutrients, milled products, such as corn, wheat, and oats, are used. In this connection it is important to note the fact that coarse oat products do not produce good results. Many investigators have found that the digestive tracts of chickens can utilize only a very small amount of crude fiber.

A well-balanced ration must contain suitable amounts of the following nutrients and food accessory substances: Carbohydrates, fats, proteins, salts (minerals), and vitamines.

Any of the ordinary cereal grains supply the carbohydrates and fats. More care in selection is necessary in securing the protein, salts, and vitamines.

The proteins of the cereal grains are present in too small amounts and are of too poor quality to produce the best results in rations for broilers and springs unless other protein concentrates are added. The results given in this bulletin show that peanut meal protein, as well as soy-bean meal protein, is especially valuable. Ordinarily poultrymen mix the ground feeds into a batter with buttermilk. The proteins of buttermilk are especially valuable, and if used in sufficiently large amounts produce very desirable results. Other protein concentrates are meat and fish scraps, cottonseed meal, coconut meal, and sesame-seed meal.

The seeds of corn, wheat, oats, and other grains lack such mineral substances as calcium, sodium, and chlorine which growing animals require. In the rations where milk (buttermilk or skim milk) is used, these ingredients are supplied in fairly adequate amounts.

During the last few years scientists have found that certain growth-promoting substances called vitamines are essential for all rations. In poultry rations the important vitamine called "Fat-soluble A" is often lacking. It is supplied by the addition of milk. Since the grains are deficient in certain minerals and in fat-soluble vitamine, it is necessary to add to mixtures of grains something containing these essential ingredients. As a rule, the addition of milk supplies these substances.

At present the milk available for poultry-fleshing purposes is largely buttermilk, fresh, condensed, or powdered (Table 1). Until more definite information on the optimum dilution of powdered and

condensed buttermilk for poultry-fattening rations is available it will probably be best to dilute the buttermilk product so that the resulting mixture will have about the same percentage of solids as fresh buttermilk (approximately 8 per cent). In using condensed buttermilk, which contains about 28 per cent of solids, the dilution would be 1 part of condensed buttermilk to 2½ parts of water. In using powdered buttermilk, which has about 90 per cent of solids, the dilution would be about 1 part of buttermilk to 10 of water.

In feeding-house practices the powdered buttermilk is most conveniently used by combining it directly with the dry feed mixture and then pouring in water to make the proper consistency. Adding 15 pounds of powdered buttermilk to 100 pounds of dry feed and mixing with 150 pounds of water gives approximately the same percentage of buttermilk solids as is obtained by using 50 pounds of fresh buttermilk to 40 pounds of dry feed.

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